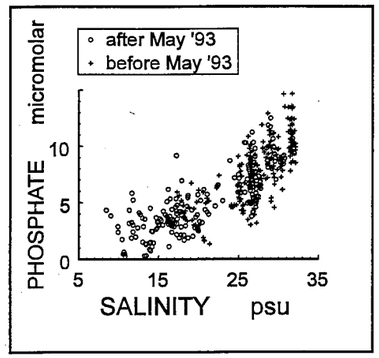

Figure 3
PHOSPHATE VERSUS SALINITY, DUMBARTON BRIDGE TO SAN MATEO BRIDGE, 1990-1996
Plus signs are observations before May 1993. Circles are observations after May 1993.

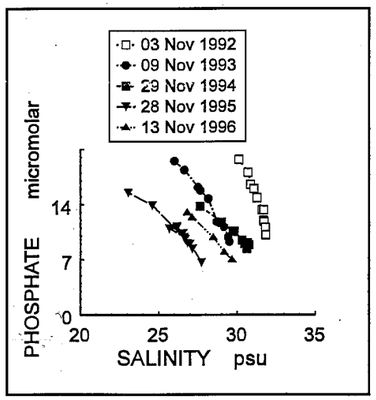

Figure 4
PHOSPHATE VERSUS SALINITY, SOUTH BAY TRANSECTS IN NOVEMBER, 1992-1996
Data from 1995 are from shallow-water locations.

A possible long-term consequence of this reduction in loading is an increased likelihood that phytoplankton bloom development may become limited by availability of phosphate rather than by nitrogen. This is because the N:P ratio of these combined effluents may, for the first time, exceed the Redfield ratio (16:1 by atoms), which approximates the ratio of N:P used in primary production. The mean N:P for the San Jose/ Santa Clara Water Pollution Control Plant from 1990 to April 1993 was 10:1, whereas from May 1993 through 1996 it was 22:1. Possible ecological effects in addition to a reduction in primary production include a change in dominant phytoplankton species during blooms (*eg*, Escaravage *et al*1996). Our long-term studies of San Francisco Bay will help detect changes, and thus we are grateful for the continuing support of the USGS National Research Program and Toxic Substances Hydrology Program and the partial support of the San Francisco Estuary Institute Regional Monitoring Program for routine data collection, which make these studies possible.

References

Conomos, T.J., R.E. Smith, D.H. Peterson, S.W. Hager, and L.E. Schemel. 1979. Processes affecting seasonal distributions of water properties in the San Francisco Bay estuarine system. Pages 115-142 in *San Francisco Bay: The Urbanized Estuary*. T.J. Conomos (ed.). Pacific Division, American Association for the Advancement of Science, San Francisco.

Escaravage, V., T.C. Prins, A.C. Smaal, and J.G.H. Peeters. 1996. The response of phytoplankton communities to phosphorus input reduction in mesocosm experiments. *Journal of Experimental Marine Biology and Ecology* 198:55-79.

Hager, S.W., and L.E. Schemel. 1996. Dissolved inorganic nitrogen, phosphorus and silicon in South San Francisco Bay. I. Major factors affecting distributions. Pages 189-215 in *San Francisco Bay: The Ecosystem*. J.T. Hollibaugh (ed.). Pacific Division, American Association for the Advancement of Science, San Francisco.

Harris, H.S., D.L. Feuerstein, and E.A. Pearson. 1961. *A Pilot Study of Physical, Chemical, and Biological Characteristics of Waters and Sediments of South San Francisco Bay (South of Dumbarton Bridge)*. Sanitary Engineering Research Laboratory, University of California, Berkeley. 257 pp.

Schemel, L.E., and S.W. Hager. 1996. Dissolved inorganic nitrogen, phosphorus and silicon in South San Francisco Bay. II. A case study of effects of local climate, and weather. Pages 217-235 in San Francisco Bay: The Ecosystem. J.T. Hollibaugh (ed.). Pacific Division, American Association for the Advancement of Science, San Francisco.

Relative Abundance and Some Aspects of the Biology of Native and Introduced Mysid Shrimp in Suisun Bay and the Delta

James J. Orsi, DFG

Invasions of exotic aquatic species have become commonplace in the Sacramento-San Joaquin estuary. The fish, benthos and plankton have all been modified extensively by intentional or accidental introductions dating back to Gold Rush times, and perhaps even earlier. Ballast water discharge from ocean-going ships has been implicated in the introduction of several species of Asian copepods since the late 1970s, and in August 1992 an Asian mysid shrimp, *Acanthomysis bowmani* sp. nov., was taken in the Sacramento and San Joaquin rivers on either side of Sherman Island (Modlin and Orsi in press). This shrimp closely resembles two Asian species: *A. sinensis*, found in the East China Sea at the mouth of the Yangtze River, and *A. longirostris*, which has been reported from the north China coast, Korea, and Japan.

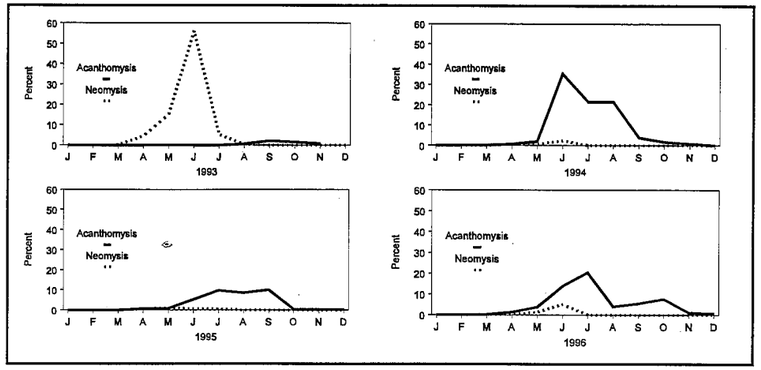

Figure 1
MONTHLY ABUNDANCE OF *A. BOWMANI* AND *N. MERCEDIS* AT ALL SAMPLING STATIONS, 1993-1996

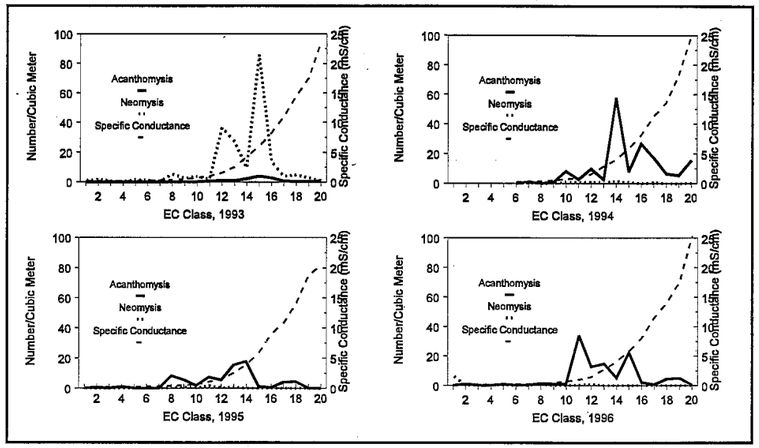

Figure 2
MEAN ANNUAL ABUNDANCE OF *A. BOWMANI* AND *N. MERCEDIS* BY SPECIFIC CONDUCTANCE CLASS

The new mysid was rare during 1992 and 1993, but in 1994 it became more abundant than the native mysid, *Neomysis mercedis*, and remained so in 1995 and 1996 (Figure 1). *N. mercedis* abundance peaked in May or June in 1992-1996. The peak for *A. bowmani* varied from June to September; in recent years it has been distinctly more abundant than *N. mercedis* in late summer and fall.

A. bowmani is somewhat more euryhaline than *N. mercedis*; it extended from fresh water to 19 mS/cm and was most abundant at 3 mS/cm (Figure 2). *N. mercedis* has historically been most numerous at 2 to 10 mS/cm.

N. mercedis is larger than *A. bowmani*. The largest *N. mercedis* females in 1994-1996 were 15 mm total length, compared to 12 mm for *A. bowmani*. Gravid (egg-bearing) *N. mercedis* females had an abundance peak at 10-12 mm compared to modes at 7 and 10 mm for *A. bowmani* (Figure 3). However, *A. bowmani* carries more eggs at the same length than *N. mercedis* does. In June 1995, 9 mm *N. mercedis* carried an average of 17.4 young vs. 30.4 young for *A. bowmani*. At 10 mm *N. mercedis* had an average of 23.2 young compared to 46.1 for *A. bowmani*. The eggs of *N. mercedis* are about 1.2 times larger than those of *A. bowmani* — 0.49 mm versus 0.41 mm. Small eggs may develop faster than large ones, so a combination of greater fecundity and faster development time may give *A. bowmani* a higher reproductive rate. Because *A. bowmani* also begins to reproduce at a smaller size, it may have a considerable competitive advantage over *N. mercedis*.

The diet of *A. bowmani* has not been investigated, but it would be expected

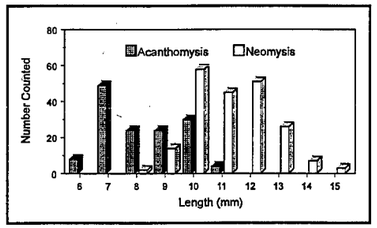

Figure 3
LENGTH DISTRIBUTION OF
GRAVID FEMALES OF
A. BOWMANI AND *N. MERCEDIS*,
1994-1996

to be similar to that of *N. mercedis*, which consists of phytoplankton and zooplankton. Small *N. mercedis* consume more phytoplankton than large ones (Baldo-Kost and Knight 1975) and because *A. bowmani* adults are smaller than those of *N. mercedis*, they may be more dependent on phytoplankton. Both species are concentrated in Suisun Marsh and the entrapment zone, so the opportunity for competition for food is large. The decline in *N. mercedis* in 1994, the first year *A. bowmani* was abundant, suggests that *A. bowmani* is out-competing *N. mercedis*.

The abundance of *A. bowmani* in late summer to fall could be advantageous to young-of-the-year striped bass, which are generally not large enough to feed on mysids in spring. Delta smelt might also benefit slightly from the timing of *A. bowmani presence*, although mysids have not comprised a large part of the delta smelt diet.

References

Baldo-Kost, A.L., and A.W. Knight. 1975. The food of *Neomysis mercedis* Holmes in the Sacramento-San Joaquin Estuary. *California Fish and Game* 61:35-46.

Modlin, R., and J.J. Orsi. In press. *Acanthomysis bowmani*, new species, and *A. aspera* Ii(Crustacea:Mysidacea),newly reported from the Sacramento-San Joaquin Estuary, California. *Proceedings of the Biological Society of Washington*.

Coordinators on Stage: An Interactive Critique of the Interagency Program

Patrick Coulston, IEP Program Manager

At the conclusion of each annual workshop, the Interagency Program seeks input on how future workshops can be improved. Following the 1996 workshop, suggestions included:

- The workshops should be more interactive (*ie,* attendees should participate more).
- The workshops should result in specific products (*ie,* more like a workshop and less like a technical conference).
- The Coordinators should play a larger role in the workshops.

To "kill three birds with one stone" the organizing committee for the 1997 workshop recommended devoting the Thursday evening session to an open, facilitated critique of the program. For roughly 2 hours the Coordinators sat on the chapel stage at the Asilomar Conference Center and responded to questions and comments from the audience about Interagency Program functions and activities. Dr. Jim Cloern, an aquatic ecologist at the USGS Menlo Park office and a member of the Science Advisory Group, facilitated the session. This article summarizes the discussion and highlights a few key points.

Another quick point about the format. Fearing that no one would have questions or comments, causing the whole event to fall flat, workshop organizers solicited questions before the workshop. However, a steady stream of spontaneous questions and comments consumed the evening, and most of the solicited questions were not addressed. We apologize to you who took the time to submit unaddressed questions. We will review them during the Coordinators' retreat.

Highlights of the Critique

- **The Central Valley Salmon project work team appears to be a good model for how the Interagency Program should function, providing a forum for coordinating all Central Valley salmon investigations. What lessons have been learned in setting up the project work team, and is the Interagency Program going to use this model in other topic areas? (Pete Rhoads, Metropolitan Water District)**

  The Central Valley Salmon project work team is a good model, but it is difficult to involve some agency staff and stakeholders that have not traditionally worked closely with the Interagency Program. In late 1995, the Directors asked the program to play more of a coordination role. The Estuarine Ecology Team is also providing a good model for other project work team's with its strong technical problem/question orientation, requirement that members participate in and contribute to team projects, and good peer review processes. The other project work team's should use both these models, as appropriate for their topic areas. The Central Valley Salmon Team's system of communication between the core team and satellite teams (sharing meeting summaries electronically) should be used to foster communication between all project work teams.

- **Does the Interagency Program have a clear goal/mission statement that is relevant to today's circumstances, and can effectively guide strategic planning? (Zach Hymanson, DWR)**

  The mission statement was revised in 1993 as part of the overall revision of the Interagency Program. The mission was broadened beyond the traditional focus on investigating bay/delta water project impacts. However, given the recent major changes in the bay/delta environmental management, regulation, and protection landscape, the goals and mission of the program should be revisited.

- **Should, and if so how, the Interagency Program get involved in the evaluation of restoration efforts resulting from the CALFED and CVPIA-AFRP processes? (Zach Hymanson, DWR)**

  At the very least, the Interagency Program should be coordinating and integrating the monitoring and evaluation of bay/delta habitat restoration projects. The Coordinators have been discussing this issue with CALFED managers, but funding constraints are limiting our ability to play this role.

- **Should and can the Interagency Program play a future "umbrella" or "clearinghouse" role for other monitoring programs (*eg,* CVPIA-CAMP), providing centralized QA/QC and data management services? (Jim McKevitt, USFWS)**

  The Interagency Program is already working with CVPIA-CAMP and CALFED representatives on the issue of managing and disseminating their monitoring data. Although the Interagency Program can clearly provide this kind of services and provide forums for coordinating and integrating monitoring efforts, the other programs may require their own independent technical review processes.

- **The Interagency Program should stop producing a large annual report and develop better approaches to reporting its results. The annual reports come out late, managers generally won't read reports of this kind, and technical results are better reported in peer-reviewed technical journals. (Lee Miller, DFG)**

  The Interagency Program does need to improve the way it reports results, both in terms of timeliness and peer review, and is actively working on this. Peer-reviewed publication should be emphasized, because it is an important mechanism for determining if monitoring and special-study funds are being well spent. DFG's Bay-Delta Division has established an in-house technical editor to facilitate production of technical reports from that office.

- **Is the Water Accord working? (Dwight Russell, DWR)**

  Determination of whether environmental protections provided by the Water Accord are effective has been confounded by recent high flows, which have made it largely unnecessary to invoke the Accord's flow- and export-related provisions. The Accord has been effective in other ways:

  (1) The parties that signed the Accord are still actively working together on solutions.

  (2) The CALFED Operations Group, supported in part by Interagency Program technical information (*eg,* real-time monitoring) has been active and effective.

  (3) Agency stakeholders have become directly involved in monitoring and finding solutions.

  Evaluation of the Water Accord and related initiatives requires a better understanding of how the bay/delta aquatic system functions. The Interagency Program needs to conduct special studies and analysis directed at understanding system processes. Since research is a "hard sell" to agency managers, the Interagency Program should develop a competitive process for identifying key research topics and selecting and supporting academic investigators to pursue those topics. The Interagency Program can also facilitate research by sponsoring or conducting workshops on key topics.

- **How well are the Coordinators working and communicating with Agency Directors? (Zach Hymanson, DWR)**

  The involvement and interest of the Agency Directors varies tremendously between agencies. DWR management is vitally interested in the Interagency Program and is pushing hard for improvement in the areas of peer review, faster information output, and equitable sharing of program costs. DWR management also believes the greater, recent involvement in the program by stakeholders has improved the program. USBR management understands the importance of the program, supports it, but is not deeply involved. SWRCB management is pleased by the direction the Interagency Program has been moving and is being encouraged by staff to support our contaminant effects work. DFG management is not as engaged in the Interagency Program as it should be, although understanding and involvement is improving. This engagement is critical to gaining the cooperation of the regional and divisional DFG units.

What Next?

How will the program respond to the discussion that took place on February 27? Many of the issues raised that evening have already been included in the list of considerations adopted to guide the 1997 Interagency Program planning. Also, on July 30 and 31, the Coordinators are holding a retreat to examine the structure and function of the Interagency Program and consider the need for changes to keep the program effective and relevant. One of the topics to be addressed is the program's response to issues raised in February. The Coordinators will present the outcome of these discussions at the 1998 annual workshop scheduled for February 25-27, 1998, at the Asilomar Conference Center.